



GYPSUM SIKA PERFORMANCE ADDITIVE TECHNOLOGIES

BUILDING TRUST





GYPSUM BOARD PRODUCTION

Gypsum boards are manufactured in a highly automated and continuous production line process. The plaster is mixed with water, various additives and prefabricated foam to form a consistent wet slurry mix. This is poured onto a heavy paper sheet, evenly distributed and covered with a second sheet of paper, and as this continues along the line the calcium sulfate binder reacts with water, sets and hardens. It can then be cut to the required board sizes and finished at the edges, so that they can be transferred into the dryers and excess water dried out, before packaging and delivery to customers ready for installation.

SIKA ADDS VALUE TO YOUR GYPSUM BOARDS

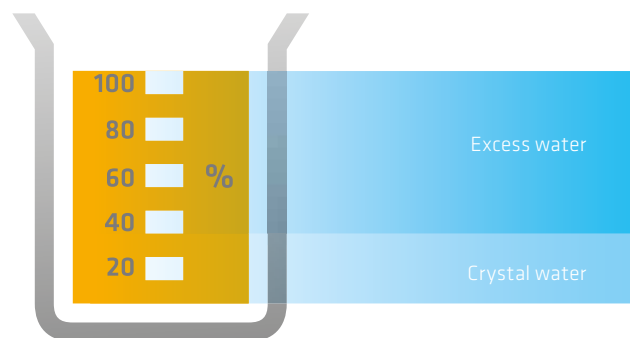
IF THE PRODUCTION OF CONSISTENT, high quality yet economical gypsum building products is your goal, Sika's performance additives are your solution.

Sika provides you with professional technical and commercial support, including timely delivery of high-quality products – all tailored to achieve your specific requirements and maximize your plant's profitability. We understand the challenges of variable raw-materials, rising energy costs and increasingly strict health and environmental legislation.

SUSTAINABILITY AND COST OPTIMIZATION

Overall sustainable production, saving energy and reducing CO₂ emissions are ever-present topics in the gypsum industry today. Several proactive measures can be taken to save resources and also costs, including the implementation of optimized mix-designs using innovative additive technologies. During today's board production, approx. 70% of the water added is not consumed in the hydration process and must be removed by heating and evaporation from the boards. This drying process is highly energy consuming and has become the main cost-driver of production. Reducing the water requirement by using innovative additive technologies like Sika® ViscoCrete® can significantly reduce these energy costs. This also results in a greatly reduced carbon footprint to be applied over the entire service life of gypsum boards.

Water demand for the liquefaction of plaster slurry



1 Natural gypsum – an important raw material source together with FGD gypsum



2 High water reduction using Sika® ViscoCrete® technology in gypsum board production

SUPERPLASTICIZERS

THE EXTENSIVE PRODUCT FAMILY developed with Sika® ViscoCrete® technology includes extremely efficient liquefiers that have been specifically tailored for gypsum applications, particularly the continuous production of boards and fiberboards, plus other prefabricated gypsum elements and blocks. Today Sika is a leading producer of PCE-based plasticizers, with our own network of Sika® ViscoCrete® production sites worldwide, and we have truly international experience with gypsum, ternary and cement binders in countless different applications.

Sika® ViscoCrete® technology is based on PCE, which was one of our innovations in the late 1990's. 'PCE' stands for Poly-Carboxylate Ether and describes a polymer which is actually similar to a comb in shape. The backbone of the comb consists of a polycarboxylic acid (polycarboxylate) and the teeth of the comb are made of polyether chains. In a comparable way to conventional plasticizers PCE molecules are adsorbed onto the surfaces of solid particles via the polycarboxylic acid in their backbone. However, the side chains are not adsorbed but extend into the aqueous solution and prevent the convergence of solid particles. This effect is known as dispersal through steric hindrance. By varying the specific PCE polymer structure, the properties of the resulting superplasticizing liquid or powder can be adjusted and modified to suit different requirements. The main parameters which are varied are the length and nature of the polycarboxylic acid backbone and the length, number and type of side chains used. In these and other ways the PCE polymer properties can be adjusted for many different applications.

In addition, the Sika® ViscoCrete® PCE technology allows target-oriented combinations with other different polymers and structures to be produced. By understanding the effects and the interaction of these, Sika can provide tailor-made solutions for many different applications and binder systems, including different calcium sulfate, ternary and cement binder systems. This in turn allows the additive and thereby the processing and the finished gypsum products essential characteristics to be precisely tailored to their respective application and requirements, particularly in terms of:

- Polymer adsorption
- Liquefaction and water reducing capacity
- Stickiness/stability/viscosity/flow
- Workability and setting characteristics
- Strength development
- Robustness with respect to variations in water content, temperature and quality of raw materials



KEY FACTORS FOR THE SUCCESS OF THE SIKA PCE TECHNOLOGY

- Tailor made designs for specific requirements
- High water reduction
- High liquefaction
- Strength increase
- Shrinkage reduction
- No release of formaldehyde
- Improved cost performance

Compared to conventional naphthalene-based plasticizers the liquefying performance of Sika® ViscoCrete® PCEs for gypsum is typically 3 to 5-times higher.

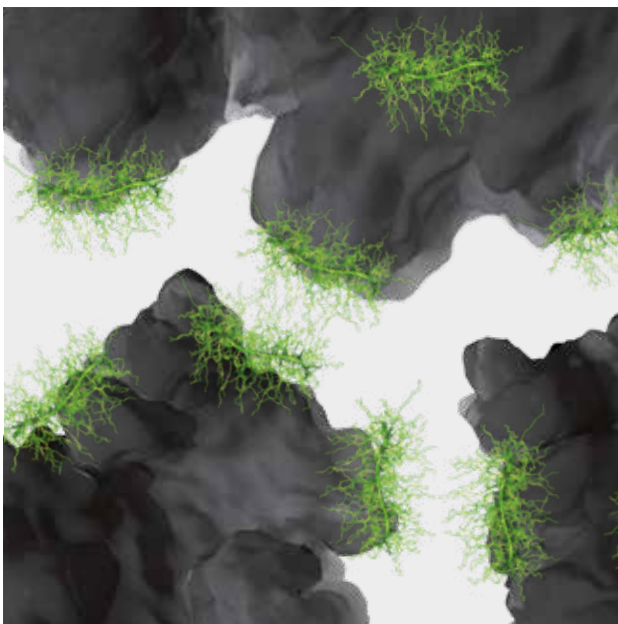
PRINCIPLE OPTIONS WHEN UPGRADING TO SIKA'S PCE-BASED HIGH-PERFORMANCE SUPERPLASTICIZERS

When switching from a mid-range to a truly high-performance superplasticizer, there are two principal options, assuming a constant slump flow is targeted:

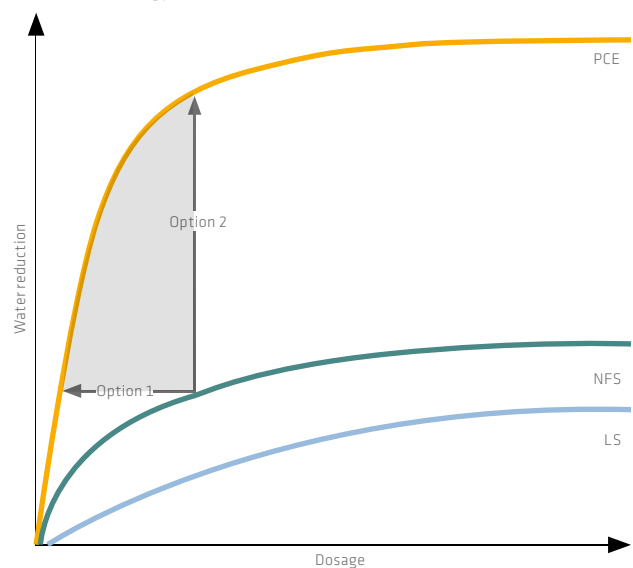
Option 1:
Reduction of the superplasticizer dosage

Option 2:
Reduction of the mix water dosage

Whilst cost savings through reduced plasticizer dosage may be attractive, the reduction of energy consumption for drying excess water in times of continually increasing energy costs, mean that optimizing the water reduction (Option 2) will achieve the highest levels of cost reduction and sustainability. Additionally, the impact of raw material variations can also be better mitigated by Sika's PCE-based superplasticizers, and this too can have a positive effect on your process stability and end product quality.



Plasticizer performance ranges and principal options when switching to Sika's PCE Technology



RETARDERS

RETARDERS ARE TYPICALLY USED to delay the onset of setting or to increase the setting time and thereby also to increase the available processing or production times of gypsum, cement and other mineral binder system. The Sika Retardan® range includes very effective gypsum retarders that are used to delay the setting of even accelerated binders, until the required processing is successfully completed.

SIKA Retardan® TECHNOLOGY

Sika Retardan® products are characterized by low dosage and high retardation effects. They give excellent performance for the adjustment of the setting and workability time with a variety of different calcium sulfate binders. Sika Retardan® is compatible with typically used mix-design components including other set-controlling agents.

The mode of action of Sika Retardan® is based on targeted intervention in the process of gypsum crystallization.

By adsorption on the gypsum crystal surfaces the further integration of calcium and sulfate ions is blocked. Thus gypsum crystal growth, and thereby setting and hardening, are retarded for a certain period of time (dependent on additive dosage). Sika Retardan® additives are valued for their especially well-defined retardation effects:

- Targeted delay of the beginning of the hydration reaction
- No reduction of hydration intensity for an early end of setting



RETARDERS IN GYPSUM BOARD PRODUCTION

Rapid setting and hardening of the gypsum is normally of crucial importance to run board production at high speed and optimal capacity utilization. The use of gypsum plaster in combination with highly effective accelerators, especially fine ground gypsum, is state of the art. Modern production lines will require the setting process to be completed in less than 10 minutes. This can normally only be achieved with high accelerator dosage, and in many cases this does not give the required processing time before the initial setting occurs. The negative effects of such early setting can be caking and clumping in the mixer, which can obviously disrupt production. In addition, any reduced flow capability also has a negative impact on the final board quality. Consequently, the beginning of setting should be delayed for a few seconds by using a well-defined retarder. Therefore the manufacture of gypsum boards today typically requires the combination of suitable retarding and accelerating additives. As a result, the so-called „snap-set“ occurs, which is typically the ideal setting curve. It is characterized by a slight extension of the dormant period and then a fast setting progress.

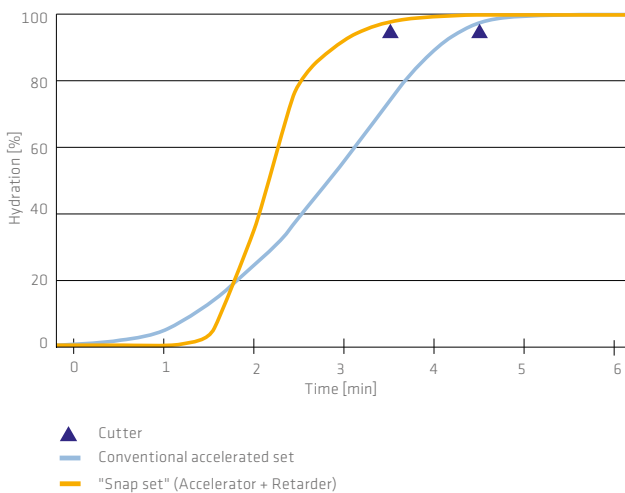
The use of Sika Retardan® during gypsum board production can therefore provide many advantages, including:

- It keeps the mixer clean
- Complete mixing of pre-generated foam and plaster slurry
- Sufficiently high wet-bond of gypsum to the paper layers
- Rapid strength development and high final strengths

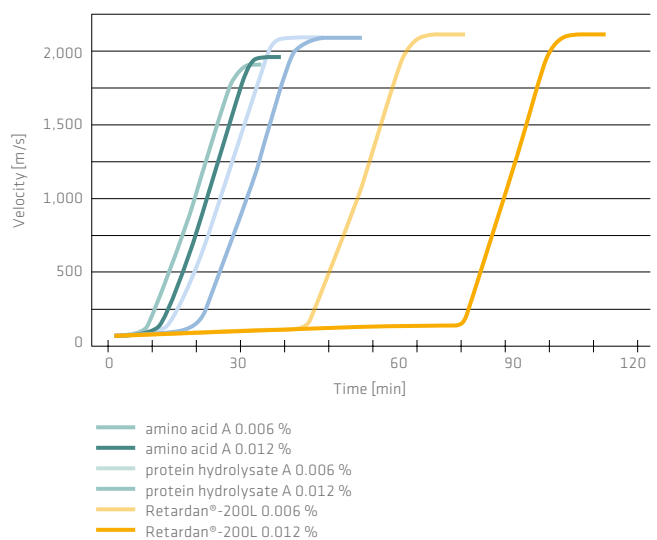
Sika Retardan® does not show the typical side effects of other gypsum retarders, especially those based on fruit acids and their salts, such as extension of the setting period and ultimate strength loss.

The Sika Retardan® range has been developed with products in both liquid and powder form to suit all of your requirements.

Optimization of the gypsum hydration process



Efficiency of different retarders (by ultrasonic-testing)



GLOBAL BUT LOCAL PARTNERSHIP



FOR MORE INFORMATION:



WHO WE ARE

Sika AG, Switzerland, is a globally active specialty chemicals company. Sika supplies the building and construction industry as well as manufacturing industries (automotive, bus, truck, rail, solar and wind power plants, façades). Sika is a leader in processing materials used in sealing, bonding, damping, reinforcing and protecting loadbearing structures. Sika's product lines feature high quality concrete admixtures, specialty mortars, sealants and adhesives, damping and reinforcing materials, structural strengthening systems, industrial flooring as well as roofing and waterproofing systems.

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SIKA SERVICES AG
Tüffenwies 16
CH-8048 Zürich
Switzerland

Contact
Phone +41 58 436 40 40
Fax +41 58 436 41 50
www.sika.com

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